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UPDATED COST EFFECTIVENESS ANALYSIS OF THE NAVY DRUG AND ALCOHOL REHABILITATION PROGRAM

by

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December, 1993

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ABSTRACT

A previous cost benefit analysis of the Navy drug and alcohol rehabilitation program equated the value of benefits to the avoided replacement costs of the service members successfully rehabilitated. This thesis updates this study. In particular, this thesis considers the replacement cost model and identifies an improvement to the previous methodology. The previous model misspecifies average replacement costs and overestimates the program benefits. A new rehabilitation treatment model is developed within this thesis. The value of the rehabilitation benefit is based on the Navy's desired manning objective. This more accurately reflects the rehabilitation benefit as the Navy downsizes its force structure.

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I. INTRODUCTION

A. BACKGROUND

American society as a whole disapproves of drug and alcohol abuse. This abuse is becoming one of the nation's most important public health problems, as well as a major reason for crime. According to former President George Bush, "Most Americans remain firmly convinced that drugs represent the gravest present threat to our national well-being." [Ref. 1:p. 3]

The military is not immune from these difficulties. Drug and alcohol abuse also negatively impact our national security. Abusers may be less productive, less reliable, become safety hazards to themselves or others, incur serious legal problems, and detract from combat readiness. Drug and alcohol abuse are not compatible with high standards of performance and military discipline, and do not promote pride, professionalism, and personal excellence. [Ref. 2:p. 1]

To combat these negative consequences, Congress mandated in the early 1970's that the military services provide rehabilitation for drug and alcohol dependent service members. Over the last twenty years, a policy of "zero tolerance" for drug and alcohol abuse has emerged. This is implemented through enhanced detection and deterrence of abuse. The main emphasis of the Navy's drug and alcohol program has been on

discipline, rehabilitation, preventive education and separation of those members with no potential for future useful service.

As the defense budget decreases, there will be increased pressure to justify continued support of the Navy's drug and alcohol program. Proponents of the program may derive necessary justification from recent cost benefit studies specifically targeting the most costly component of the program: inpatient rehabilitation. The most recent cost benefit analysis prepared for the Bureau of Naval Personnel (BUPERS) compared rehabilitation treatment costs with the benefits of avoided replacement costs of those personnel successfully rehabilitated. However, the methodology used in this analysis does not reflect issues facing the Navy today, such as downsizing and decreasing end strength.

B. PURPOSE AND SCOPE

This thesis will analyze the methodology to derive replacement costs used in the latest cost benefit study and update its findings. It will then attempt to define a more accurate and current personnel model for evaluating the value of the drug and alcohol rehabilitation treatment for those members successfully treated. It will determine what factors should be considered when figuring rehabilitation value, and how current Navy policies and issues effect the opportunity cost of separating members. This should provide a better

estimate of the true economic cost to the Navy of replacing drug and alcohol abusers.

II. BACKGROUND

This chapter provides an overview of the Navy's drug and alcohol abuse prevention program, including the levels of treatment, and a discussion of the most recent cost benefit analysis of the drug and alcohol rehabilitation program.

A. NAVY DRUG AND ALCOHOL ABUSE PREVENTION PROGRAM

Although the Navy recognizes that the individual has primary responsibility for preventing drug and alcohol abuse, it has established a fairly comprehensive three level program focusing on education, awareness, identification, and treatment: Level I, II, or III. Level I involves local command programs; Level II treatment is provided by Counseling and Assistance Centers (CAACs); Level III treatment is a residential rehabilitation program.

1. Level I

The Level I program consists of both intervention and prevention efforts for all command personnel and aid to non-dependent drug and alcohol abusers. Intervention is through discipline, administrative screening, urinalysis testing, and individual evaluations, such as fitness for duty and medical evaluations. Prevention ensures all hands are aware of drug and alcohol abuse consequences, through general military training, positive leadership, and structured education programs. One available education program is Personal

Responsibility and Values Education and Training (PREVENT). PREVENT is a 36 hour course designed to increase individual awareness of drug and alcohol abuse dangers.

2. Level II

Level II treatment is provided by CAACs for those personnel who are not drug or alcohol dependent, but whose degree of abuse requires further attention than that available through Level I. CAAC programs include "clinical screening by qualified personnel, referral to all program levels and resources, therapeutic counseling, outreach assistance, and education." [Ref. 2:p. 6-3]

3. Level III

Level III is a residential treatment program designed for those personnel who are diagnosed as drug or alcohol dependent. This program is administered at the Navy's Alcohol Rehabilitation Centers (ARCs) and Alcohol Rehabilitation Departments (ARDs). ARCs are free-standing residential facilities, while ARDs are treatment departments within a Naval hospital. The six-week treatment programs at the ARCs and ARDs are very similar. They include individual and group counseling, workshops, physical fitness, and attendance at a twelve step program such as Alcoholics Anonymous (AA). Only those personnel who exhibit an exceptional potential for further useful service may receive Level III treatment. [Ref. 3: p. 8].

4. Program Implementation

Service members are treated at the lowest level that is consistent with the degree of affliction and the amount of attention required to modify the abusive behavior. Known or suspected drug or alcohol abusers are evaluated by a physician, clinical psychologist, or CAAC screener to determine the nature and extent of abuse, evaluate potential for further useful service, and recommend the appropriate level of counseling or rehabilitation. It is the service member's Commanding Officer who decides if the member will attend treatment. Drug or alcohol abusers may be processed for separation from the Naval service based on their alcohol or drug dependency status, rank/paygrade, and number of incidents. An explicit breakdown of treatment vice separation criteria is contained in OPNAVINST 5350.4B. [Ref. 2:p. 7-7] Although the instruction does indicate that drug abusers may receive rehabilitation treatment, it is now rare for a drug abuser not to be separated from the service.

B. MOST RECENT COST BENEFIT STUDY

The most recent cost benefit study of the Navy's Level III treatment program was completed in 1989 for PERS-6 by Caliber Associates. The study's basic assumption was that Navy personnel who are alcohol or drug dependent would, without further successful rehabilitation, have to be replaced, incurring replacement costs. The study compared per capita rehabilitation costs to the avoided cost of replacing a

successfully rehabilitated individual of the same rating and length of service.

1. Derivation of Costs

Rehabilitation costs were defined to include: [Ref. 4:p. 26]

- Program costs for ARCs and ARDs
- Patient transportation to and from the facility
- Patient salary while in treatment
- Cost of retreating recidivists

The total average cost per patient was determined to be $5029, in 1983 dollars.

A successful rehabilitation was defined as a patient who: [Ref. 4:p. 28]

- Completed the program
- Completed the term of enlistment
- Was recommended for reenlistment
- Experienced no further drug or alcohol related incidents in that period

Absence of further alcohol or drug related incidents is based on hospitalization for "simple drunkenness," alcoholism, improper use of drugs, or drug dependence.

Caliber used a treatment cohort of 7256 enlisted personnel with data from the Naval Health Research Center on Navy rehabilitation patients from 1982 to 1984. Of this cohort, 3863 were determined to be program successes. With a rehabilitation cost of $5029 per service member, the total cost to treat the cohort was $36,490,424, in 1983 dollars.

Based on inflation rates from 1983 to 1992, this is now equivalent to $51,086,594.[1]

The Navy's 1982 selective reenlistment bonus (SRB) program model was used to develop cost estimates for replacement values of each of the program successes. Cost factors included in the SRB model include: [Ref. 4:p. 77]

- Recruitment costs
- Recruit training costs
- Pay and allowances while in recruit training
- "A" school (rating/skill training) costs
- Pay and allowances while in "A" school
- Instructor costs

From these factors, a training cost was obtained. Length of service (LOS) was divided into intervals equivalent to the three SRB zones (2 to 6 years, 7 to 10 years, 11 to 14 years). Each LOS zone had the number of accessions necessary to replace each rating at that LOS. Appendix A provides examples of the major model elements.[2]

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[1] Inflation rate from 1983 to 1992 of 40% was applied. [Ref.5:p. 352]

[2] For the purposes of this thesis, and due to the large amount of data contained in the Caliber study, only a representative portion of the SRB model will be exhibited in the appendix.

2. Application of SRB Model

The SRB model was applied to the 3863 program successes. The rating of each service member was matched to the ratings in the model, and the LOS was matched with the appropriate LOS interval. The corresponding accession factor (number of accessions to replace each rating) was multiplied by the appropriate training cost to obtain the estimated replacement cost. Some examples of how the replacement costs were calculated are contained in Table 2-1. Ratings were available for 2930 of the 3863 program successes, so an average per person replacement value was calculated for those individuals for which ratings were known and subsequently applied to all the program successes.

TABLE 2-1
SRB MODEL EXAMPLES

Rating	Length of Service	Accession Factor	Training Cost	Replacement Cost
HT	5	7.77	$20,537	$159,572.49
IM	14	27.81	$33,465	$930,661.65
EO	10	6.81	$14,330	$97,587.30

The overall average per person replacement cost was $122,829. Applying this value, a total cost savings for the cohort of successfully rehabilitated service members was determined to be $474,488,427. Inflated to 1992 dollars, this equates to $664,283,798. Based on this methodology, comparing the total treatment costs to the total avoided replacement costs, the

Navy's Level III program appears overwhelmingly cost beneficial with a benefit to cost ratio of 13:1.

III. DATA ANALYSIS

The best procedure to analyze the Caliber study's findings was by duplicating the methodology employed. Permission was received from PERS-63, the sponsor of the Caliber study, to obtain the data used in the study. All data had been formatted for manipulation by personal computer database management programs. The data consisted of two files which contained the information pertaining to the 3863 service members considered program successes. After identifying and verifying the data fields necessary to implement the methodology described in the study, one database was restructured with the minimum amount of information required: rating and length of service. Paygrade data was also retained in order to resolve any potential data inconsistencies that may have surfaced. Since this thesis focuses on the replacement cost methodology, the factors for determining which service members successfully completed rehabilitation (program successes) were not evaluated.

A. UPDATE TO CALIBER STUDY

The Caliber report stated "although the SRB program replacement cost data are not exact, they are reported to be the best estimates of replacement costs for the various rating groups." [Ref. 4:p. 79] A search for a more precise personnel replacement cost model, preferably based on rating

and paygrade vice LOS, proved fruitless. However, Automation Management Consultants, Inc (AMCI) performed a study for PERS-23 in 1989 to examine, refine, and update the replacement costs used in developing SRB program plans.

1. AMCI Methodology

The AMCI methodology is based on continuation rates for each rating. A continuation rate is the percent of personnel of a specified rating and LOS that proceed to the next LOS. A continuation rate is computed by "taking the current inventory for a particular LOS and dividing this figure by the inventory of the corresponding previous LOS from the previous time period." [Ref. 6:p. 2] Exceptions for the first and second years of service were described, but are based on the same concept. Year end data from fiscal years 1987 and 1988 from the Enlisted Master Record were used. Continuation rates were computed for all possible ratings, up to 21 years of service. Appendix B contains some examples of the continuation rates.[3] The inverse of the cumulative continuation rate for a rating at a specific LOS yields the number of accessions required to produce that one service member. Replacement costs are then obtained by multiplying the training cost by the number of accessions. Appendix C contains some examples of replacement costs by rating and LOS.

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[3] As noted in Chapter II, the entire AMCI SRB model will not be exhibited due to its large size. A representative selection of ratings will be shown.

Training costs were provided by the Chief of Naval Education and Training (CNET) for fiscal year 1987. Replacement costs are typically used for reenlistment zones rather than specific LOS, therefore AMCI calculated zone replacement costs for each rating by taking the weighted average of the replacement cost for each LOS within the zones. Reenlistment zones are the same as those used by Caliber. Appendix D contains examples of replacement costs by zone for the same ratings as listed in Appendix A (Caliber figures).

2. Application of Model

As can be noted from the information contained in Appendix C, the AMCI SRB model can be applied more precisely, by specific LOS, than Caliber's SRB model, which used only the three zones. This should estimate a more accurate and current avoided replacement cost for those personnel successfully rehabilitated. Costs were entered into the database for each individual based on rating and LOS. Although Caliber reported ratings were available for only 2,930 service members, careful review of the database identified ratings for 3,182 members. Of the remaining 681 members, 539 were considered general apprenticeship, a term for those personnel in paygrades E-1, E-2, and E-3 who do not possess a rating. Only 142 records contained no rating or apprenticeship information. Training costs were not available for all ratings, consequently replacement costs could not be entered for 952 records. An average per person replacement cost was calculated for those

individuals on which ratings and replacement costs were known, and applied to all 3,863 records. This resulted in the following figures:

- Average replacement cost of $208,225.
- Total avoided replacement cost of $804,165,177.

Inflated from 1987 to 1992 dollars, the successful rehabilitation of these personnel provided the Navy a savings of $974,648,195.[4] This seemingly more precise replacement cost model indicates a 30% greater savings to the Navy than the original cost benefit study, and produces a program benefit to cost ratio of 20:1.

B. METHODOLOGY REFINEMENTS

Any program manager would be thrilled to learn that his/her program was so incredibly cost beneficial. However, based on the updated SRB model, the success ratio could theoretically be reduced to as low as 3%, and the benefits of the Level III rehabilitation program would still appear to exceed the costs. (This would occur with a blanket application of the average replacement cost vice figuring the replacement cost of each individual.) This leads one to search for refinements in the methodology when applying the SRB models to a cost benefit analysis.

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[4] The inflation rate from 1987 to 1992 was 21.2%. [Ref. 5:p. 352]

1. Value vs Cost

When measuring the benefits received by successfully rehabilitating a service member, that member's worth must be determined. The benefit is not necessarily the avoided cost to replace that service member, but perhaps his/her value to the Naval service. The benefit should be appraised as the minimum of the individual's value or replacement cost. For example, an AT with 20 years experience (an LOS of 20) would cost $152,849 to replace (refer to Appendix C). However, this provides no indication of the individual's performance, skill, contributions to his/her command, or contributions to the Navy. Is this AT a second class petty officer (E-5) who has not worked hard enough to advance and is now waiting for retirement, or a master chief petty officer (E-9) whose skills and initiative contributed to an accelerated advancement? Clearly, if the service member was sent to Level III treatment, he/she is considered of some value to the Navy. However, the pertinent question is whether that member's value exceeds (or is less than) the full replacement cost. Unfortunately, the difficulty in resolving this disparity lies in the problem of assigning a quantitative value to a mostly qualitative measure.

2. Rating and Paygrade Requirements

The Navy has specific manning levels that it attempts to maintain. These requirements are based on rating and paygrade. For example, the total number of E-9s serving on

active duty may not exceed 1% of the total enlisted population, and the total number of E-8s and E-9s may not exceed 3% of the total enlisted population. [Ref. 7] The rating and paygrade of the individuals successfully rehabilitated should be compared to the current rating and paygrade authorizations. This may provide an additional measure of that service member's relative value to the Navy as a whole. Following from the previous example, if AT2s (E-5 AT) are manned at 105%, and the total rate (all paygrades) is overmanned, the Navy is not avoiding a replacement cost through rehabilitation, but may in fact be incurring additional costs by retaining that service member. Although an individual command may be disadvantaged due to the loss of the service member, the Navy as a whole may benefit.

The 3,863 Level III successes were rehabilitated in 1982, 1983, or 1984; 1983 will be used as a base year for comparison purposes, since all monetary figures are also based on 1983. A review of the Caliber database revealed 562 individuals in 48 rates in which the current authorizations were exceeded[5]. This represents 14.6% of the program successes that perhaps should not be counted as avoided

[5] It is important to differentiate between rating and rate. Rating is the occupation of an enlisted service member which requires related aptitudes, knowledge, training and skill. Rate identifies an individual by rating and paygrade, reflecting levels of aptitude, experience, and responsibility. [Ref. 8:p. III]

replacement costs. The criteria for exceeding the authorization are defined as:

- Total number on active duty for a specific rate exceeded 100% of authorization.
- Total number on active duty for the specific rating exceeded 100% of authorization.

Rating as well as rate was evaluated for a better picture of the overall manning; a rate may be manned at a level greater than the authorization, but if the rating in general is undermanned, these additional personnel may be required to fill vacant billets. Appendix E contains an explicit breakdown of the number of program successes by rating that exceeded authorizations. As previously mentioned, the Level III treatment data was collected for a three year period, but compared to statistics for only one "base" year. The numbers are therefore not exact, but are sufficient to demonstrate the concept presented.

3. Replacement Cost Distortion

Review of the rating training costs indicated reasonable values. The Caliber model's values ranged from $5,517 to train an LI to $115,682 to train an MT (1983 dollars). The AMCI model's values ranged from $7,616 for a DP to $54,208 for a CTM (1987 dollars). However, the actual replacement costs had a much wider range. Caliber's minimum and maximum replacement costs were $27,784 for a DS with an LOS of 2 years, to $930,662 for an IM with an LOS of 14 years. AMCI's replacement costs ranged from $8,256 for an SH with an

LOS of 1 year to $60,240,916 for an HT with an LOS of 21 years. Excessive replacement costs such as $60.2 million for the HT can distort computations of benefits received. (Appendix C contains the accession breakdown to derive the HT replacement costs.)

A $60 million replacement cost for a senior HT poses the question of whether the Navy should set a maximum value for its enlisted personnel. Can one rationally say that one individual is worth millions of dollars to the Navy? Without setting a maximum allowable replacement cost value when applying the Caliber methodology with the AMCI SRB model, a few incredibly high replacement costs will distort the average replacement cost and cause it to increase drastically. After performing the initial computations previously discussed in section A, a $1,000,000 replacement cost limit was set. Eight ratings in the AMCI SRB model had replacement costs that exceeded the limit: ASE, ASM, DS, GSM, HT, IC, IM, TD. Any replacement costs greater than the limit were set to $1 million. This limit affected 34 records. New avoided replacement cost computations resulted in the following:

- Average replacement cost of $82,761.
- Total avoided replacement costs of $319,621,094.

Inflated to 1992 dollars, the total avoided cost is equivalent to $387,380,766. This is 60% less than the "limitless" cost and now provides the Level III program with a benefit to cost ratio of 8:1.

C. NEED FOR AN ALTERNATE METHODOLOGY

Based on the aforementioned problems, the avoided replacement cost issue needs to be evaluated again. This entails developing an alternate model that accounts for the problem areas and current Navy personnel issues. With the Navy downsizing over the next few years, the end strength will be decreased through normal attrition, fewer accessions, and voluntary separations. The requirement for fewer personnel cannot be ignored when evaluating benefits received from any personnel program.

IV. PRESENTATION OF NEW MODEL

The methodology employed by Caliber assumes that the replacement cost of each individual successfully rehabilitated is equivalent to the value of the treatment. The model developed in this chapter suggests that the desired end results of what the Level III program is trying to achieve must be evaluated to determine the true value of the rehabilitation. One desired result of the rehabilitation program is to positively influence Naval readiness by helping to maintain the desired manpower level. (For purposes of this thesis, the social issues surrounding rehabilitation and treatment of drug and alcohol abusers will not be addressed).

Through rehabilitation, effective personnel retention rates are increased, as compared to separating all abusers. The effects and costs of the increased retention rates can be compared to other alternatives that produce desired end strengths, or certain levels of manning at specific experience levels (either LOS or paygrade). First a general model will be introduced, followed by an application to actual Navy personnel statistics.

A. GENERAL MODEL

The general model will compare the costs of achieving specific manning levels through increased accessions and through rehabilitating service members.

1. Definition of Variables

The variables incorporated into this model are:

- E_n-number of personnel at the nth experience level. E_0 is the number of entry level personnel (accessions) with no experience.
- E_T-steady state end strength.
- R_n-rate at which E_n personnel are retained to the next experience level.
- r_i-cumulative product of R_i.
- F_S-steady state factor. This factor multiplied by the number of accessions (E_0) provides the steady state level. $F_{S(R)}$ is the steady state factor when rehabilitation is considered.
- A_n-the affliction rate, or percentage of E_n personnel not retained to the next experience level due to drug or alcohol abuse.
- S -the percentage of afflicted personnel who are successfully rehabilitated and retained to the next experience level.
- X_i-cumulative product of $(R_i + S*A_i)$.
- C_0-the cost to train entry level personnel (accessions).
- C_T-the cost of drug or alcohol rehabilitation treatment.

As Navy personnel become more senior, or attain higher levels of experience, retention rates do in fact increase. To reflect this, $R_1<R_2<R_3$. Also, as personnel become more senior, the tendency to abuse drugs or alcohol decreases, so $A_1>A_2>A_3$.

2. Basic Equations

In the case of no rehabilitation treatment, the number of personnel at each experience level is simply the percentage retained from the previous experience level. For example,

$E_1=R_1E_0$ and $E_2=R_2E_1$. The iterative nature of these calculations leads to the basic equations $E_i=E_0r_i$ and $E_T=F_SE_0$. Appendix F details the formulation of these equations.

Consideration of the rehabilitation treatment is only slightly more complex. The number of personnel at a specific experience level equals the percentage retained from the previous level plus those afflicted personnel who are successfully rehabilitated. For example, $E_1=R_1E_0+SA_1E_0$ and $E_2=R_2E_1+SA_2E_1$. Appendix F further develops this to show that $E_i=E_0X_i$ and $E_T=F_{S(R)}E_0$.

3. Baseline Calculations

To illustrate this model, the following values are assigned to the variables:

$E_0 = 125$ $\quad$ $A_1 = .10$
$R_1 = .60$ $\quad$ $A_2 = .08$
$R_2 = .70$ $\quad$ $A_3 = .05$
$R_3 = .80$ $\quad$ $S = .50$
$C_0 = 50$ $\quad$ $C_T = 30$

Applying these values to the basic equations provides a starting point for the analysis, as displayed in Table 4-1.

TABLE 4-1
BASELINE MANNING LEVELS

	E_0	E_1	E_2	E_3	E_T
No Rehab	125	75	52.5	42	294.5
With Rehab	125	81.25	60.13	49.60	315.98
Δ	0	6.25	7.63	7.60	21.50
# Treated	0	12.50	6.50	3.01	22.01
# Success	0	6.25	3.25	1.50	11.00

The "Δ" row shows the increase in the number of personnel retained due to rehabilitation treatment at each experience level, with a net end strength increase of 21.5. The costs associated with the baseline figures are in Table 4-2.

TABLE 4-2
BASELINE LEVEL COSTS

	E_0	# Treated	Training Cost	Rehab Cost	Total Cost
No Rehab	125	0	$6250	$0	$6250
With Rehab	125	22	6250	660	6910

4. Alternative Options

As previously mentioned, the value of rehabilitation treatment should be measured by evaluating the costs to achieve similar retention results and/or manning levels. The new model will present four manning alternatives, assuming four experience levels and no rehabilitation treatment.

- Option 1 - same end strength (E_T) as with treatment.
- Option 2 - same E_1 level as with treatment.
- Option 3 - same E_2 level as with treatment.
- Option 4 - same E_3 level as with treatment.

The total accessions required for the manning target for each option can be determined using the calculations presented earlier. First, a new variable will be introduced. E_{Di} is defined as the number of accessions required to reach the desired manning level for experience level "i," or E_{DT} for desired end strength. Further calculations in Appendix F show

that $E_{Di}=E_0(X_i/r_i)$ and $E_{DT}=E_00(F_{S(R)}/F_S)$. The calculated values for r_i and X_i are summarized in Table 4-3. Please note that r_i and X_i for E_T are F_S and $F_{S(R)}$ respectively.

TABLE 4-3
ACCESSION FACTORS

Factor	Corresponding Experience Level			
	E_1	E_2	E_3	E_T
r_i	.60	.42	.336	2.36
X_i	.65	.481	.397	5.53

Table 4-4 displays the manning levels for the four options, compared to levels considering the effects of rehabilitation. The Δ rows show the increase or decrease in manning at each level for the four options.

TABLE 4-4
ALTERNATIVE MANNING LEVELS

	E_0	E_1	E_2	E_3	E_T
Rehab	125	81.25	60.13	49.60	315.98
Option 1	134.12	80.47	56.33	45.06	315.98
Δ	9.12	(0.78)	(3.80)	(4.54)	0
Option 2	135.42	81.25	56.88	45.50	319.04
Δ	10.42	0	(3.25)	(4.10)	3.06
Option 3	143.15	85.89	60.12	48.10	337.27
Δ	18.15	4.64	0	(1.50)	21.29
Option 4	147.63	88.58	62.0	49.60	347.81
Δ	22.63	7.33	1.88	0	31.83

The costs of these options are displayed in Table 4-5. The "Cost Accessions" column includes the training costs of the additional accessions required to meet the option goal. (The number of additional accessions can be found in Table 4-4 in the Δ rows under the E_0 column.) "Total Cost" is the total training costs. "Savings" is the cost saved by not performing rehabilitation treatment, and is the difference between the total costs with rehabilitation treatment ($6910.19) and the total training costs of each option. Negative numbers indicate that the cost of rehabilitation is lower than the cost of that particular option.

TABLE 4-5
COSTS OF ALTERNATIVE OPTIONS

	Cost of Accessions	Total Cost	Savings
Option 1	$455.82	$6705.82	$204.37
Option 2	520.83	6770.83	139.35
Option 3	907.74	7157.74	(247.55)
Option 4	1131.42	7381.42	(471.23)

These figures illustrate that the benefit of the rehabilitation treatment depends on the manning target. The value of the treatment can be measured by the additional training costs for the additional accessions. If maintaining a certain end strength is the goal (Option 1), lower costs are realized by increasing accessions. However, each experience level has fewer personnel. Options 2 through 4 target manning

requirements at specific experience levels. To meet these goals, each lower experience level exceeds the corresponding level when rehabilitation is allowed. When the desired manning level is consistent with Option 4 (same E_3 as with rehabilitation treatment), end strength exceeds the rehabilitation baseline by 10%, all experience level goals are met or exceeded, and the cost is 7% greater than rehabilitation.

It is Option 4 that reflects the Caliber methodology. By bringing in enough accessions to meet the highest experience level goal, each lower experience level has excess personnel and the end strength will increase. Knowing that the Navy force of the future is downsizing, the Caliber methodology overestimates the value of the rehabilitation. It is probably more realistic to target mid-level experience levels, as in Option 3. Option 3 produces an end strength only 7% greater than the baseline. The treatment value is figured 20% lower than a Caliber type analysis (i.e. Option 4). Although this is a very general model with only four experience levels, the concept is applicable to analyzing the benefits received from the Level III program.

B. APPLICATION OF MODEL

As discussed in Chapter III, a large replacement cost distortion may be evident when using the Caliber methodology for determining the value of successful rehabilitation. To compare the Caliber methodology with the new model, on a

manageable scale, statistics for enlisted personnel in general, and the HT rating specifically, will be applied to the model.

1. Personnel Statistics

Data from fiscal year 1992 (FY 92) and the Caliber study is used to generate the required statistics. Paygrades (E-1, E-2,...E-9) will be used to represent experience levels.

a. Retention Rate

Overall retention rates were not available for the HT rating. FY 92 reenlistment rates were used as the best approximation. If a service member does not reenlist, he/she either separates from the service or extends on the current enlistment. At the end of the extension, separation or reenlistment are the only options. A critical assumption when using the reenlistment rates as approximations is that the number of personnel selecting to extend, vice reenlist, is evenly distributed across paygrades. In this case, reenlistment rates would not vary significantly from actual retention rates. Table 4-6 displays reenlistment rates for HTs by paygrade [Ref. 9:p. 102] and the corresponding variables used in the model. There is no retention rate variable R_1 in order to maintain consistency with the paygrades (no E-0).

b. Affliction Rate

Data from the Caliber study was used to generate affliction rates for each HT paygrade. With access to only

TABLE 4-6 FY 92 HT RETENTION RATES		
Paygrade	**Reenlistment Rate**	**Variable for Model**
E-1	.348	R_2
E-2	.348	R_3
E-3	.348	R_4
E-4	.485	R_5
E-5	.578	R_6
E-6	.853	R_7
E-7	.986	R_8
E-8	.99	R_9
E-9	.99	-

the data on Level III program successes, the number of HTs actually receiving rehabilitation treatment had to be estimated based on the number of successes by paygrade and thesuccess rate figured by Caliber. Table 4-7 displays the distribution of HTs considered successes, the estimated number receiving treatment, the FY 92 year end distribution of HTs [Ref. 9:p. 42], corresponding affliction rates, and the corresponding variables for use in the model. There is no affliction rate variable A_1 in order to maintain consistency with the paygrades.

c. Other Variables

The success rate and cost of rehabilitation calculated by Caliber will be used in this application. The HT training cost from the AMCI report will be used as the

training cost. All figures are in 1992 dollars. These values are listed below:

$S = 0.53$
$C_T = \$7,041$
$C_0 = \$14,237$

TABLE 4-7
HT AFFLICTION RATES

Paygrade	HT Successes	Est HTs Treated	FY 92 Figures	Affliction Rate	Variable for Model
E-1	5	9	168	.05	A_2
E-2	11	21	703	.03	A_3
E-3	17	32	756	.04	A_4
E-4	21	40	2,333	.02	A_5
E-5	28	53	2,682	.02	A_6
E-6	22	42	2,303	.02	A_7
E-7	16	31	718	.04	A_8
E-8	1	2	184	.01	A_9
E-9	1	2	101	.02	-

2. HT Application

The general model was expanded to accommodate nine paygrades. The baseline levels were based on the actual FY 92 authorized HT end strength figure of 8321 personnel. [Ref. 9:p. 42] To produce the specified end strength, the model determines the appropriate number of accessions. As previously discussed in section A.5, accessions are calculated based on the HT accession factors displayed in Table 4-8. The desired end strength is divided by the corresponding accession factor ($F_{S(R)}$) to determine the required accessions. A constant input

of 5077 accessions will produce a total of 8321 HTs. The baseline HT figures and associated costs are presented in Table 4-9.

3. Alternative Options

Four manning alternatives based on no rehabilitation treatment were evaluated. Three of the options focused on the mid-level paygrades, E-4 through E-6. The personnel in these paygrades are the backbone of the Navy work force. Thus, maintaining the required manning in these paygrades is critical to the success of most Navy commands. The options evaluated are:

- Option 1 - same end strength (E_T) as with treatment.
- Option 2 - same number of E-4 as with treatment.
- Option 3 - same number of E-5 as with treatment.
- Option 4 - same number of E-6 as with treatment.

Accessions (E-1) for each option were determined based on the HT accession factors, as previously explained in section A.5. Table 4-10 displays the manning levels and costs for each option, and compares the costs to the rehabilitation case. The Δ columns show the increased or decreased manning at each paygrade for each option. The "Cost of Accessions" row includes only the incremental costs of the accessions above the rehabilitation baseline. "Savings" is the cost saved by not performing rehabilitation treatment. It is the difference between the total costs with rehabilitation treatment

TABLE 4-8 HT ACCESSION FACTORS					
Factor	Corresponding Paygrade				
	E-1	E-2	E-3	E-4	E-5
r_i	1.00	.348	.121	.042	.020
X_i	1.00	.375	.136	.050	.025
	E-6	E-7	E-8	E-9	E_T
r_i	.012	.010	.0099	.0098	1.57
X_i	.015	.0127	.0128	.0127	1.64

TABLE 4-9 HT BASELINE LEVELS AND COSTS					
	No Rehab	With Rehab	Δ	# Treated	# Success
E-1	5077	5077	0	0	0
E-2	1767	1901	135	254	135
E-3	615	692	77	57	30
E-4	214	255	41	28	15
E-5	104	127	23	5	3
E-6	60	75	15	3	1
E-7	51	64	13	1	.5
E-8	51	65	14	3	1
E-9	50	65	15	1	.5
E_T	7988	8321	333	352	186
Training Costs	$72,281,249	$72,281,249	-	-	-
Rehab Costs	0	2,470,824	-	-	-
Total Costs	72,281,249	74,750,273	-	-	-

TABLE 4-10 HT ALTERNATIVE MANNING LEVELS AND COSTS									
	With Rehab	Opt 1	Δ	Opt 2	Δ	Opt 3	Δ	Opt 4	Δ
E-1	5077	5288	211	6061	984	6194	1117	6307	1230
E-2	1901	1840	(61)	2109	208	2155	254	2195	294
E-3	692	640	(52)	734	42	750	58	764	72
E-4	255	223	(32)	255	0	261	6	266	11
E-5	127	108	(19)	124	(3)	127	0	129	2
E-6	75	62	(13)	72	(3)	73	(2)	75	0
E-7	64	53	(11)	61	(3)	62	(2)	63	(1)
E-8	65	53	(12)	60	(5)	62	(3)	63	(2)
E-9	65	52	(13)	60	(5)	61	(4)	62	(3)
E_T	8321	8321	0	9537	1216	9745	1424	9924	1603
Cost of Accessions		$3,009,293		$14,013,324		$15,899,350		$17,516,503	
Total Cost		75,290,542		86,294,573		88,180,599		89,797,752	
Savings		(538,469)		(11,542,500)		(13,428,526)		(15,045,679	

($74,752,073) and the total costs of each option. Negative numbers indicate that the cost of rehabilitation is lower than the cost of that particular option.

The Caliber methodology calls for 1481 additional accessions to replace the rehabilitation successes. (Refer to Table 4-11). The resulting replacement cost (and treatment value) is $21,084,285. Although each of the four options analyzed here is more costly than the rehabilitation baseline, the value of the treatment is based on the cost of the

additional accessions required to achieve the target manning levels.

TABLE 4-11 CALIBER APPLICATION TO HT			
	With Rehab	Caliber Method	Δ
E-1	5077	6558	1481
E-2	1901	2282	381
E-3	692	794	102
E-4	255	276	21
E-5	127	134	7
E-6	75	77	2
E-7	64	66	2
E-8	65	65	0
E-9	65	65	0
E_T	8321	10317	1996
Cost Accessions		$21,084,285	
Total Cost		93,366,246	

Option 4 provides a realistic level from which to measure treatment value. With a goal of maintaining E-6s at a desired level, all lower paygrades exceed the rehabilitation levels of manning. This ensures the Navy's most valuable workers are included in the benefits. The end strength is 19% greater than authorized, and the value of the rehabilitation treatment ($17,516,503) is 17% less than Caliber's value.

4. Downsizing

The Navy has already begun downsizing to meet the "force of the future." The effects of a decreasing end strength will be felt by all ratings. This also has an effect on the value of the Level III rehabilitation treatment. As the Navy requires fewer personnel, the value of retaining additional personnel also decreases. This can be shown by using projected future year end strength figures to compare treatment values, when the goal is to ensure a specific manning level of E-6s.

a. Projected HT End Strength

One assumption used for determining future HT end strength authorization is that reductions will be evenly distributed across all ratings. Given the projected Navy enlisted end strengths for FY 94 and FY 96 [Ref. 10], the percentage decreases from FY 92 are applied to the actual HT FY 92 figure, as shown in Table 4-12.

TABLE 4-12
DECREASING END STRENGTH

	Total Enlisted	% Decrease	HT End Strength
FY 92	485,507	-	8321
FY 94	404,631	16.66%	6935
FY 96	363,535	25.12	6231

b. Rehabilitation Value

Based on the HT end strength values in Table 4-12, the total cost with and without rehabilitation are compared under Option 4 for each of the three fiscal years. As mentioned previously, this option maintains an E-6 manning level to measure the rehabilitation value. Table 4-13 displays the comparisons. Clearly, the lower the manning requirements, the lower the true value of rehabilitation treatment.

TABLE 4-13
FISCAL YEAR COMPARISONS

	Total Accessions	Cost (Value)
FY 92	1230	$17,516,503
FY 94	1026	14,601,111
FY 96	921	13,117,539

V. CONCLUSION

A. SUMMARY

A previous cost benefit analysis of the Navy drug and alcohol abuse rehabilitation program equated the value of benefits received to the avoided replacement costs of the service members successfully rehabilitated. This thesis updated this study. In particular, this thesis considered the replacement cost model and identified an improvement to the previous methodology. The previous model misspecifies average replacement costs, and overestimates the program benefits. A new rehabilitation treatment model was developed. The value of rehabilitation was based on the Navy's desired manning objective. This most accurately reflects the rehabilitation benefit as the Navy downsizes its force structure.

B. GENERAL CONCLUSIONS

The Caliber study provided an exhaustive analysis, based on thorough research, of the costs pertaining to the Navy Level III program. However, the value of the successful treatment must be viewed as more than simple replacement costs. The true value of the rehabilitation is the minimum of the replacement costs, the value of the personnel to the Navy, or the cost to achieve the same end strength through other means, such as an increase in reenlistment bonuses to change the retention rate. Through the model developed in this

thesis, one can see that there are numerous ways to evaluate rehabilitation value, depending on the manning levels the Navy hopes to maintain. The Level III rehabilitation program remains a viable and useful program for the Navy and its service members, both socially and economically. Application of the basic model to all ratings and program successes will undoubtedly prove the program to be cost beneficial, but with a benefit to cost ratio less than Caliber's 13:1. One must remember that this is true only when applying the model developed in this thesis. Further analysis of other methods to achieve the same manning levels may prove the program less cost effective.

C. RECOMMENDATIONS

The model presented in this thesis can be considered a preliminary analysis of the rehabilitation value issue. The first recommendation is to make the model more precise by obtaining more accurate retention rates. The model must then be applied to all ratings and program successes to determine a total program benefit. Finally, using the same basic concept of true rehabilitation value, other alternatives to achieve the desired manning levels should be evaluated. For example, retention rates are affected by increasing salaries. The treatment value would equal the additional outlays in salary to maintain the target manning levels. This is very similar to the SRB program already used by the Navy.

APPENDIX A

SRB MODEL USED BY CALIBER
(Selected Ratings)

Rating	Accessions to Replace			Training Cost Per Person
	LOS 2-6	LOS 7-10	LOS 11-14	
ABH	5.55	5.55	9.60	$17,275
AMH	6.48	11.29	13.41	$7,762
AQ	3.38	6.49	9.66	$36,782
AT	3.00	6.52	8.78	$41,195
BT	6.40	10.68	13.47	$16,009
CTM	2.04	2.99	3.94	$35,495
DS	2.28	5.90	10.20	$12,186
EN	6.38	10.05	11.56	$16,059
EW	4.56	8.46	12.41	$60,250
GSE	2.16	3.05	4.63	$74,246
HT	7.77	12.98	16.84	$20,537
IM	15.94	20.74	27.81	$33,465
ML	21.91	29.59	29.59	$8,538
MT	1.72	2.75	4.04	$111,233
OS	5.52	6.99	7.88	$7,321
PR	4.96	7.39	8.11	$9,827
QM	6.85	12.02	17.13	$5,900
SK	5.22	8.37	9.70	$8,452
SW	1.83	3.4	4.62	$31,008
YN	3.37	5.08	6.01	$13,092

Source: Caliber Associates, "Cost Benefit Study of the Navy's Level III Alcohol Rehabilitation Program, Phase Two: Rehabilitation vs Replacement Costs," 1989, Appendix C.

APPENDIX B

CONTINUATION RATES FOR SELECTED RATINGS

LOS	RATING			
	AT	HT	OS	YN
1	0.86	0.97	0.88	0.92
2	0.97	0.90	0.91	0.93
3	0.95	0.84	0.96	0.92
4	0.92	0.68	0.77	0.91
5	0.71	0.35	0.49	0.65
6	0.93	0.67	0.79	0.87
7	0.81	0.67	0.92	0.89
8	0.84	0.70	0.92	0.84
9	0.81	0.67	0.84	0.84
10	0.89	0.70	0.89	0.90
11	0.90	0.68	0.90	0.92
12	0.94	0.70	0.93	0.93
13	0.95	0.63	0.92	0.93
14	0.94	0.59	0.94	0.96
15	0.95	0.65	0.90	0.98
16	0.97	0.58	0.96	0.96
17	0.98	0.63	0.96	0.98
18	0.98	0.66	0.94	0.98
19	0.98	0.71	0.98	0.99
20	0.93	0.77	0.99	0.95
21	0.61	0.50	0.67	0.59

Source: Automation Management Consultants, Inc., "Replacement Costs for U.S. Navy Enlisted Personnel,"1989.

APPENDIX C

REPLACEMENT COSTS FOR SELECTED RATINGS

LOS	RATINGS							
	AT		HT		OS		YN	
	Training: $21994		Training: $11747		Training: $22646		Training: $14550	
	Access	Repl $	Access	Repl $	Access	Repl $	Access	Repl $
1	1.16	$25574	1.03	$12210	1.14	$25734	1.09	$15815
2	1.20	26365	1.15	13456	1.25	28279	1.17	17006
3	1.26	27753	1.36	16019	1.30	29458	1.27	18484
4	1.37	30166	2.01	23557	1.69	38257	1.40	20312
5	1.93	42488	5.73	67306	3.45	78075	2.15	31250
6	2.08	45686	8.55	100457	4.36	98829	2.47	35920
7	2.56	56402	12.76	149936	4.74	107422	2.77	40359
8	3.05	67146	18.23	214195	5.16	116763	3.30	48046
9	3.77	82896	27.21	319694	6.14	139004	3.93	57198
10	4.23	93141	38.88	456705	6.90	156184	4.37	63553
11	4.71	103490	57.17	671625	7.66	173538	4.75	69080
12	5.01	110096	81.68	959465	8.24	186600	5.11	74279
13	5.27	115891	129.65	1522960	8.96	202826	5.49	79870
14	5.61	123288	219.74	2581288	9.53	215773	5.72	83198
15	6.90	129777	338.06	3971212	10.59	239747	5.96	86665
16	6.08	133790	582.87	6846918	11.03	249737	6.20	90276
17	6.21	136521	925.18	10868124	11.49	260142	6.33	92118
18	6.33	139307	1401.79	16466854	12.22	276747	6.46	93998
19	6.46	142150	1974.36	23192753	12.47	282395	6.53	94948
20	6.95	152849	2564.10	30120458	12.60	285248	6.87	99945
21	11.39	250573	5128.20	60240916	18.80	425743	11.64	169398

Source: Automation Management Consultants, Inc., "Replacement Costs for U.S. Navy Enlisted Personnel," 1989.

APPENDIX D

SRB MODEL DEVELOPED BY AMCI
(Selected Ratings)

Rating	Accessions to Replace			Training Cost Per Person
	Zone A	Zone B	Zone C	
ABH	1.67	4.67	7.92	$11,100
AMH	1.49	3.30	5.05	$10,728
AQ	1.34	3.93	8.90	$21,994
AT	1.31	2.57	4.21	$21,994
BT	1.40	3.13	5.25	$15,800
CTM	1.06	1.68	2.94	$54,208
DS	1.14	3.22	8.53	$42,446
EN	1.61	3.89	6.18	$19,506
EW	1.42	3.26	5.15	$15,712
GSE	1.16	1.71	2.14	$31,056
HT	2.77	19.46	90.37	$11,747
IM	1.90	5.23	11.92	$18,846
ML	2.58	6.78	9.47	$14,440
MT	1.22	2.46	4.59	$32,930
OS	1.73	4.60	7.02	$22,646
PR	1.49	2.87	4.04	$15,860
QM	1.62	3.12	4.26	$8,870
SK	1.38	2.45	3.52	$15,805
SW	1.68	5.20	7.24	$10,917
YN	1.52	2.98	4.61	$14,550

Source: Automation Management Consultants, Inc., "Replacement Costs for U.S. Navy Enlisted Personnel," 1989.

APPENDIX E

RATING AND RATE EXCESSES

Rating	Rating % on Board	Rate % on Board	Successes Represented
ABH3	111.8	101.2	10
ADC	103.5	104.0	5
AD2	105.1	104.0	12
AD3	114.5	104.0	18
AE3	114.9	102.4	8
AG2	109.2	100.4	3
AG3	108.2	100.4	3
AK1	109.4	104.3	7
AK3	111.7	104.3	10
AMEC	118.9	102.2	2
AME2	110.4	102.2	5
AME3	106.2	102.2	2
AMH2	114.8	107.6	15
AMH3	111.7	107.6	12
AMS3	114.5	100.7	14
AQ2	116.3	107.2	6
AQ3	117.9	107.2	1
AT3	109.5	102.3	17
BU2	104.0	104.2	2
BU3	117.5	104.2	5
DK2	104.6	102.0	1
DK3	110.2	102.0	3
DP2	106.2	107.8	2
DP3	129.1	107.8	9

Source: FY-83 Annual Report, Navy Military Personnel Statistics, NAVPERS 15658(A), 30 September 1983.

Rating	Rating % on Board	Rate % on Board	Successes Represented
DS2	117.8	106.3	4
DS3	112.2	106.3	12
EO3	122.0	103.2	2
ET2	105.4	100.1	23
ET3	113.1	100.1	32
FTB3	106.9	102.5	3
GSM2	124.4	108.2	5
GSM3	113.5	108.2	1
HM3	118.4	103.8	41
MM2	113.3	102.3	54
MM3	112.2	102.3	64
MT1	102.6	103.5	1
MT2	123.9	103.5	3
PH2	121.8	104.6	2
PH3	101.9	104.6	2
PNC	103.1	104.4	7
PN2	110.5	104.4	14
PN3	119.0	104.4	14
SH(all)	101.5-108.0	103.6	36
STS3	140.2	102.5	3
TM2	113.2	101.5	5
TM3	103.3	101.5	9
YN2	103.4	101.8	22
YN3	115.3	101.8	31

APPENDIX F

MODEL CALCULATIONS AND EQUATIONS

NO REHABILITATION TREATMENT

E_0 is exogenously given and assumed to be constant; R_0=1

$$E_0 = R_0 E_0$$
$$E_1 = R_1 E_0 = R_0 R_1 E_0$$
$$E_2 = R_2 E_1 = R_2 R_1 R_0 E_0$$
$$E_3 = R_3 E_2 = R_3 R_2 R_1 R_0 E_0$$
$$\therefore E_n = E_0 \prod_{j=0}^{n} (R_j)$$

Let $r_i = \prod_{j=0}^{i} (R_j)$

$$\therefore E_i = E_0 r_i$$

Steady state end strength:

$$E_T = \sum_{i=0}^{n} (E_i) = E_0 r_0 + E_0 r_1 + E_0 r_2 + \ldots E_0 r_n = E_0 (r_0 + r_1 + r_2 + \ldots r_n)$$

Let $F_S = \sum_{i=0}^{n} (r_i)$

$$\therefore E_T = F_S E_0$$

WITH REHABILITATION TREATMENT

E_0 is exogenously given and assumed to be constant

R_0=1; A_0=0

$$E_0 = R_0 E_0 + SA_0 E_0 = E_0 (R_0 + SA_0)$$
$$E_1 = R_1 E_0 + SA_1 E_0 = E_0 (R_1 + SA_1) = E_0 (R_0 + SA_0)(R_1 + SA_1)$$
$$E_2 = R_2 E_1 + SA_2 E_1 = E_1 (R_2 + SA2) = E_0 (R_0 + SA_0)(R_1 + SA_1)(R_2 + SA_2)$$
$$E_3 = R_3 E_2 + SA_3 E_2 = E_2 (R_3 + SA_3) = E_0 (R_0 + SA_0)(R_1 + SA_1)(R_2 + SA_2)(R_3 + SA_3)$$
$$\therefore E_n = E_0 \prod_{j=0}^{n} (R_j + SA_j)$$

Let $X_j = R_j + SA_j$

Let $X_i = \prod_{j=0}^{i} (x_j)$

$$\therefore E_i = E_0 X_i$$

Steady state end strength:

$$E_T = \sum_{i=0}^{n} (E_i) = E_0 X_0 + E_0 X_1 + E_0 X_2 + \ldots E_0 X_n = E_0 (X_0 + X_1 + X_2 + \ldots X_n)$$

Let $F_{S(R)} = \sum_{i=0}^{n} (X_i)$

$$\therefore E_T = F_{S(R)} E_0$$

ACCESSIONS FOR OPTIONS

$E_i = E_0 r_i$, *with no rehab*

Let $E_0 = E_{Di}$

$\therefore E_i = E_{Di} r_i$

$$E_{Di} = \frac{E_i}{r_i}$$

Desire same manning level as with rehab,

so $E_i = E_0 X_i$

$$\therefore E_{Di} = \frac{E_0 X_i}{r_i}$$

For the same end strength:

$E_T = F_S E_0$, *with no rehab*

Let $E_0 = E_{DT}$

$\therefore E_T = F_S E_{DT}$

With rehab, $E_T = F_{S(R)} E_0$

Desire same manning level as with rehab,

so $E_T = F_S E_{DT} = F_{S(R)} E_0$

$$\therefore E_{DT} = \frac{F_{S(R)} E_0}{F_S}$$

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